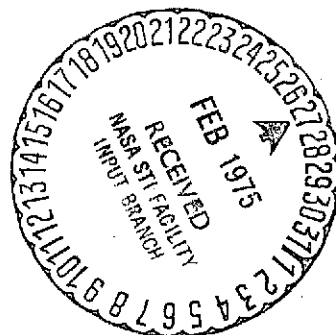


MAN — EARTH — UNIVERSE

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We can now divide the era of the conquest of space into three periods. The first breakthrough into space was made to overcome the Earth's attraction. The second stage, if it may be called this, was the "impatient" study of space in all possible and available directions. This was the study of circumterrestrial space, the study of the Earth from space, the Moon, and medical-biological experiments. The behavior of man under spaceflight conditions was also studied. In this second stage, the investigation of space was carried out equally in all directions, but on the third stage — on the basis of results from the previous period — one predominant direction began to appear.

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This was the investigation of the Earth from space and the investigation of space for the benefit of mankind on the Earth. As the president of the International Astronautics Federation (IAF), L. Napolitano, stated at the 24th Congress in Baku (1973), mankind first looked at the sky from the Earth, and now he was looking from the sky to the Earth. This did not completely eliminate other space studies and experiments which did not have an immediate and explicit connection with an investigation of our planet: the Earth and its surroundings were not isolated from the rest of space. This meant that these relationships had to be studied and, in addition, any information about space sooner or later could be used for the needs of humanity.

*Numbers in the margin indicate pagination of original foreign text.

**USSR Pilot-Cosmonaut.

Ecological Problems and Cosmonautics

Recently, ecological problems have been becoming much more important. This is due to the rapid increase in population, the pollution of the environment as a result of human activity, which has reduced certain kinds of natural resources. There are no miraculous ways to immediately solve the threat of an ecological crisis. Numerous measures, including the use of spacecraft, must be implemented in order to improve the situation.

The French scientist, A. Laneau, in discussing the possible ways to change the composition of the atmosphere as a result of the contamination by industrial effluents, assumes that in 100 years mankind will "either live on the Earth, under the Earth, /3 or on another planet" [1].

Many foreign authors believe that mankind will take refuge in space from a polluted Earth. F. Fiorio states that "in actuality, we are exploring space because something tells us that we must do this to survive. It is possible that after several centuries mankind, after a great deal of blood and tears in order to make all possible attempts to achieve happiness, and finally polluting and draining all resources from our old planet, will be forced to make the following choice: to explore the stars and to search for a new world which is habitable and just as light and pure as the Earth was before we appeared on it many thousands of centuries ago" [2].

It is impossible to agree with this point of view, since in essence it does not attempt to solve present and future ecological problems and incorrectly represents the role of cosmonautics as eliminating the ecological threat on the Earth. We assume that the conquest of space is not entirely the result

of "an ecological consciousness," not entirely due to an involuntary striving of mankind to create the means to escape from the Earth. No, the necessity of conquering space was due purely to the development on the Earth of industry, science, technology, etc. Spacecraft are not a way to escape from the Earth, but an important instrument for investigating the surrounding environment and the natural resources, an instrument which can assist in overcoming many ecological difficulties.

For a long period of time, the Earth has completely met all the requirements of society. According to the writings of K. Marx, during this time man has reacted to nature, to "this primary source of all the means and objects of labor, as the owner" [3]. The scientific-technical and social progress has reached a limit when our planet has found its own limitations in terms of several parameters, and limitations have appeared in the previous relationship of mankind to nature. The realization and even the "feeling" of the finiteness, the limitations of the Earth in several respects has been augmented by the fact that even human activity has led in several cases to a severe deterioration of the environment, and that the measures of individual governments to conserve the environment have been inadequate.

The conquest of space has played an important role in solving ecological and industrial problems related to the contradiction between the increasing activity of mankind and the limitations of the Earth. Space technology has made it possible to use more effectively the resources of the Earth, and to conserve the environment more successfully.

This has been apparent, in the first place, in studying the Earth from space by means of artificial satellites and orbital stations, particularly to search for natural resources and to assist in forecasting weather.* In the second place, this is apparent in the use of space and spacecraft for the needs of industry (navigational and other applied satellites).** In the third place, this is apparent in revealing from space the harmful pollution by mankind of nature (detection of contaminated waters, atmosphere, changes in the animal and plant world) over enormous distances. To study these phenomena on the Earth would require a great deal of time and effort. Fourthly, this is apparent in the use of information about space and methods to conquer space to develop industry. Finally, in the fifth place, if we refer to the far distant future, we can speak of the organization in space of industries which produce the greatest contamination of the natural environment. Naturally, these are only a few of the possibilities.

The Soviet geographer, K. Ya. Kondrat'yev calls the study of natural resources and the environment from space, space geography, or space ecology. The present stage of space geography can be arbitrarily called the information stage, and the amount of information from space about the Earth is consequently increasing and is now reaching gigantic proportions.

*For certain specific methods and results of studying the Earth by means of spacecraft, see: Yu. V. Zonov. Artificial Satellites of the Earth Study the Environment. Priroda, No. 12, 1973, p. 3; Sagdeyev, R. Z. Zaytsev, Yu. I. Scientific Studies in Space — Certain Results, Problems, and Prospects. Priroda, No. 5, 1974.

**This is of great economic importance. For example, the United States spent 28 billion dollars in 1959 — 1969 on communication satellites (approximately the same amount as for the "Apollo" project). By 1970, these satellites had returned a profit of 56 billion dollars to the United States, and by 1987 it is assumed they will return a profit of 207 billion dollars ("Aviation Week and Space Technology," Vol 98, No. 17, 1973, pp. 63 — 64).

Space Geocentrism ?

Previously, "before the discovery of Copernicus," wrote M. Born, "mankind thought they were masters of the universe, since they believed that the Earth was located in the center. Then the concepts of Copernicus were advanced, who made the Earth one of many planets" [4].

Although the Earth is not the center of the universe, the statement of this fact does not change the situation that for man — his activity is the center.

The concept of the Earth as one of several planets in the universe was, without doubt, a revolutionary advance in the minds of mankind, without which another revolutionary conclusion could not have been reached, that made by K. E. Tsiolkovskiy: the possibility of human flight into space.

However, since humanity lives only on the Earth and has still not inhabited other planets, geocentrism of practical activity will not be surmounted for a long time. Here geocentrism is understood not in the pre-Copernicus sense, but in a different, social-astronomical sense, namely: even in the present age of the conquest of space, the Earth remains the center of conscious and practical activity. /4

It is interesting that this conclusion was reached by F. Engels even before the era of the conquest of space. Noting that the geocentric point of view in astronomy is limited and must be rejected in terms of accuracy, he wrote that "as we perform more and more research, it will more and more contain its own validity" [5]. The very important thinking of Engels indicates that for us only geocentric physics, chemistry, biology,

meteorology, etc., are possible. These sciences do not lose any validity due to the fact that they only hold true for the Earth and, therefore, are only relative. "If we require a science which has no center, then we stop the progress in every science" [6].

Here the concept of the center of the development of science has a double meaning: firstly, as the beginning in time of consciousness (consciousness first began with the human reflection of the Earth's environment) and, secondly, as the spatial center of consciousness. In another work "Dialectics of Nature," Engels asserts that "for terrestrial mechanics, physics, and chemistry, we are more or less limited — and entirely limited for organic science — by our small Earth. Nevertheless, this does no harm to the infinite variety of phenomena or the consciousness of nature, just as it does not harm history, which is similar but even more limited by its comparatively short period of time and small portion of the Earth" [7].

Geocentrism, about which Engels speaks, is not the geocentrism which was opposed by Copernicus. Engels is speaking about the historical and spatial characteristics of our consciousness, caused by the fact that it began on the Earth, and not somewhere in the universe. The beginning conquest of space does not change this characteristic in any way.

Repudiating astronomical geocentrism, mankind nevertheless repudiates the geocentrism of his own existence and activity with difficulty. Even before the beginning of the space era, the practical activity of humanity was entirely limited by our planet, and then it passed beyond its boundaries. Even extra-terrestrial centers of consciousness appeared — for example,

spacecraft on the Moon. Nevertheless, the new centers were not only connected with the traditional center of consciousness, the Earth, but still only existed because this was necessary for human progress.

The penetration of man into space did not weaken the dependence of humanity on the Earth. Instead, the dependence of humanity on the Earth became even more apparent in space. Therefore, the change, which is beginning at the present time, of space research as a "window" on the Earth does not represent a new fashion. The concept itself of the "space era" is arbitrary in nature. It is used primarily to identify the fact that we are beginning to explore space using space and rocket technology. The concept of the "space era" does not mean that we are forsaking the Earth and migrating to space. The Earth remains the center, from which mankind has not decided to leave forever, never to return. The indifference of men, who have penetrated space, toward the Earth, if it appears, will be slight, if it appears at all

In the sense that we usually employ it, "geocentrism" represents a form of anthrocentrism, but not in the old derogatory sense of the word. Anthrocentrism is used primarily in the sense that there are no other intelligent beings, except for the inhabitants of the Earth, in the solar system. Secondly, this term implies that the Earth, as well as everything else existing in the solar system, may be used by man for his further progress. The predominant position of the Earth among all the remaining bodies in space is due only to the fact that mankind exists upon it.

As the Earth begins to lose this predominant position, the end is in sight for cosmic geocentrism; it is replaced by cosmic anthrocentrism. The essential point, which is invariant in time, is the existence and progress of humanity, and not of the Earth. Mankind takes care of and conserves the environment on the Earth only because he lives on it, while the terrestrial environment is his residence.

The problem of cosmic geocentrism and cosmic anthrocentrism has another aspect, related to the possible existence of other civilizations outside of the Earth. As is well known, certain theoretical and experimental experiments are being performed to discover extraterrestrial civilizations and to communicate with them. All of these experiments are based on the assumption that, if mankind arose, other intelligent beings could exist in other parts of the universe.

Is there any reason why other civilizations could not exist in actuality? At first glance, this question seems absurd. However, there is a certain probability that it has an affirmative answer, and it is not accidental that this question is seriously raised by the well-known specialist in problems of extraterrestrial civilizations, the Soviet astronomer I. S. Shklovskiy [8].

It is well known that the ideas of geocentrism and anthrocentrism in their old medieval variations were erroneous. However, there was a grain of truth in them. Repudiating the medieval interpretation of these ideas, we may give them a new interpretation. It is possible that we may even not want to call them "geocentrism" and "anthrocentrism," but however we may designate these concepts, they have features which are similar to the earlier ideas of geocentrism and anthrocentrism, although as a whole they contradict them.

Conquest of Space and the Earth: A Systems Approach

The Earth, space, and mankind may be regarded as a complete system. Previously, separate elements of this system were regarded as independent systems. For example, the "Earth-space" system was studied by natural sciences, the "mankind-Earth" system was studied by the social disciplines. With the emergence of the space era, the problem arose of synthesizing the systems into a "mankind-Earth-space" system.

Changing from the "mankind-Earth" system to the "mankind-Earth-space" system is not only changing from a small volume of space to a large volume, but also represents the formation of a wider system of relationships and interaction between humanity and nature. The expansion of human activity to a wider system of relationships and interrelationships is due to the requirements of the development of scientific-technical and social progress. The problems confronting mankind require a change to a wider system whose components, and the interrelationships among them, can solve these problems.

In this case, the situation of the conquest of space is not altogether unique. It has been established in different branches of science that, to solve a certain problem (as a system), it is advantageous to exceed its boundaries and pass through a wider system. This approach frequently leads to solving the formulated problem by entirely new methods, which in principle could not exist in the previous system. This is possible because proceeding to a wider system and using new methods provide additional information making it possible to correctly solve the formulated problem. Space research and the use of spacecraft in the interests of science and the national economy is a clear example of this general rule. In a brief period of time, results were

obtained which in general could not have been obtained by using traditional methods on the Earth, or, in rare cases, could only have been obtained in the far distant future.

In the pre-cosmic stage of the history of mankind, the limitations of the Earth played a positive role, but then the spatial forms of human activity stopped corresponding to it. Before the entry into space, space factors were encroaching upon this activity: information about space and its use, simulation of processes in space for scientific and industrial purposes, etc. This entry of space factors into the conscious activity of humanity (or, as it is now called, the process of cosmicization) was apparently begun in antiquity. Copernicus gives a clear characterization of this continuous and explicit nature of cosmicization: the consolidation of geocentrism was greatly stimulated by the thinking of natural scientists and was aimed at a wider use of information about space.

The discoveries of Copernicus had a systems characterization: he indicated that all of the celestial bodies existing in the vicinity of the Earth belonged, not to the Earth, but to the Sun, and they all were called the solar system. The systems concepts, begun by Copernicus and completed by his predecessors, however, only represented a picture of nature as it existed before, and independently of, mankind. Using this picture, Tsiolkovskiy made the following important step: he assumed that mankind may be a systems-forming factor in space.

In terms of the systems approach, the Earth is only an element, a component in one system — the solar system. In principle, the concept of the Earth is limited, if mankind uses only methods on the Earth and only on the conditions of the Earth. The Earth, as an element in the solar system, in this

case cannot divulge all of its secrets, because the key to many of these secrets does not lie within the Earth. If the Earth is a component of a wider system, many of the phenomena on the Earth depend on the components of this wide system, particularly on the systems-forming center — the Sun. Therefore, many scientists, when studying certain phenomena on the Earth and not finding satisfactory answers for the reasons for their existence, assume that the key to many of the problems on the Earth may be found in space.*

There is a very precise polarization of opinions in the foreign literature devoted to the phenomenon of cosmonautics. There are many adherents of "mankind" who, as a rule, are against the conquest of space (in any case, extensive conquest) and who wish to deal exclusively with problems on the Earth (the so-called "anthropological-humanistic" direction). They clash with the technocrats — the supporters of the conquest of space, who assume that the conquest of the vastness of the universe will be a panacea from all the pains and difficulties of progress. Faced with this erroneous dilemma, "humanity (the Earth) or space," and specifying individual components of the "humanity-Earth-space" system which is being formed, certain Western authors break apart this organic unity and, whether they wish to or not, objectively come out against humanity.

The dialectical-materialistic concept of the study and conquest of space by mankind does not have anything in common with the alternative extremes of Western ideologists. Mankind develops the Earth, and strives to conserve and multiply the resources of the Earth within the expanses of the universe.

*See, for example, the book: "P. Russo. Zemletryaseniya (Earthquakes), Moscow, 1966, p. 240.

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